

A NITROGEN EMISSION MAP FOR CATCHMENTS BASED ON STREAM MEASUREMENTS USED TO CALCULATE NITROGEN EMISSIONS FROM AGRICULTURAL AREAS IN THREE SMALL DANISH CATCHMENTS

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RESULTS FROM THE GUDP PROJECT: EMISSION BASED NITROGEN AND AREA REGULATION IN DENMARK (2014-2018)

- NITROGEN REGULATION BASED ON LOCAL MEASUREMENTS

The root zone



Drain



Stream



OBJECTIVES

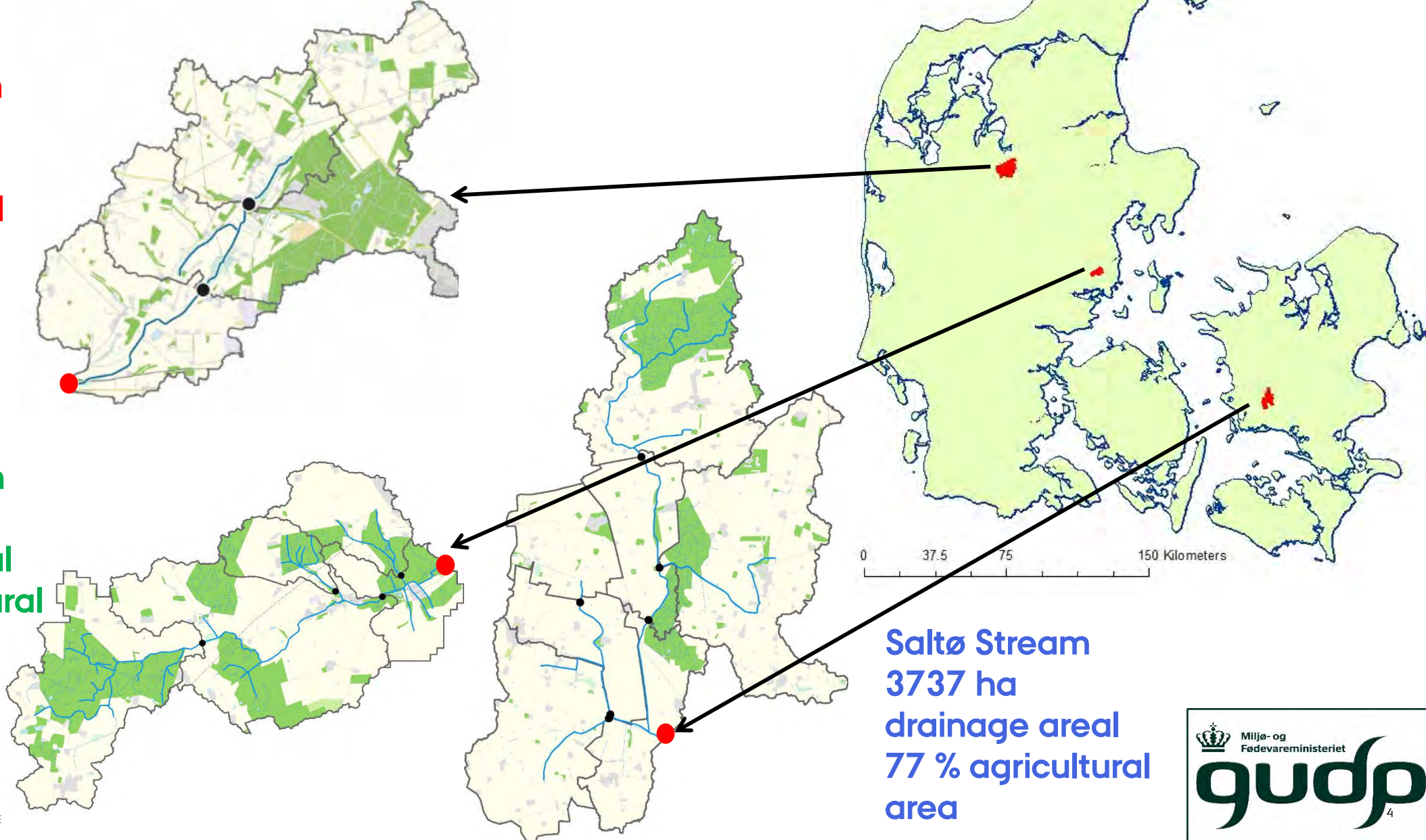
- To investigate the possibility to create a local nitrogen emission map based on stream measurements in three different Danish pilot catchments (200-1200 ha)
- To investigate the spatial variation in nitrogen emissions on a local scale
(How close to the farm can we go by using stream measurements?)
- To explore the local groundwater retention of nitrogen based on the nitrogen emissions from agricultural areas

WHERE DID WE MEASURE? THE THREE DANISH CATCHMENTS

Jegstrup Stream
2173 ha
no drainage
64 % agricultural
area

Odder Stream
1786 ha
drainage areal
62 % agricultural
area

Saltø Stream
3737 ha
drainage areal
77 % agricultural
area



WHEN AND WHAT DID WE MEASURE? FROM NOV. 2014 TO OCT. 2016

Jegstrup Stream



Odder Stream



Saltø Stream



Main stations (3 in total)

Daily measurements of TN and nitrate-N with automatic sampler (ISCO).

Discharge station as reference for synchronous stations - water flow measured every week - fourteenth day

Synchronous Stations (12 in total)

Water samples taken as grab samples every fourteenth days and discharge(Q) measured every fourteenth days

Each synchronous station is then related to the main station by calculating daily mean discharge(Q-Q relations)

METHOD

Water sample



X

Discharge

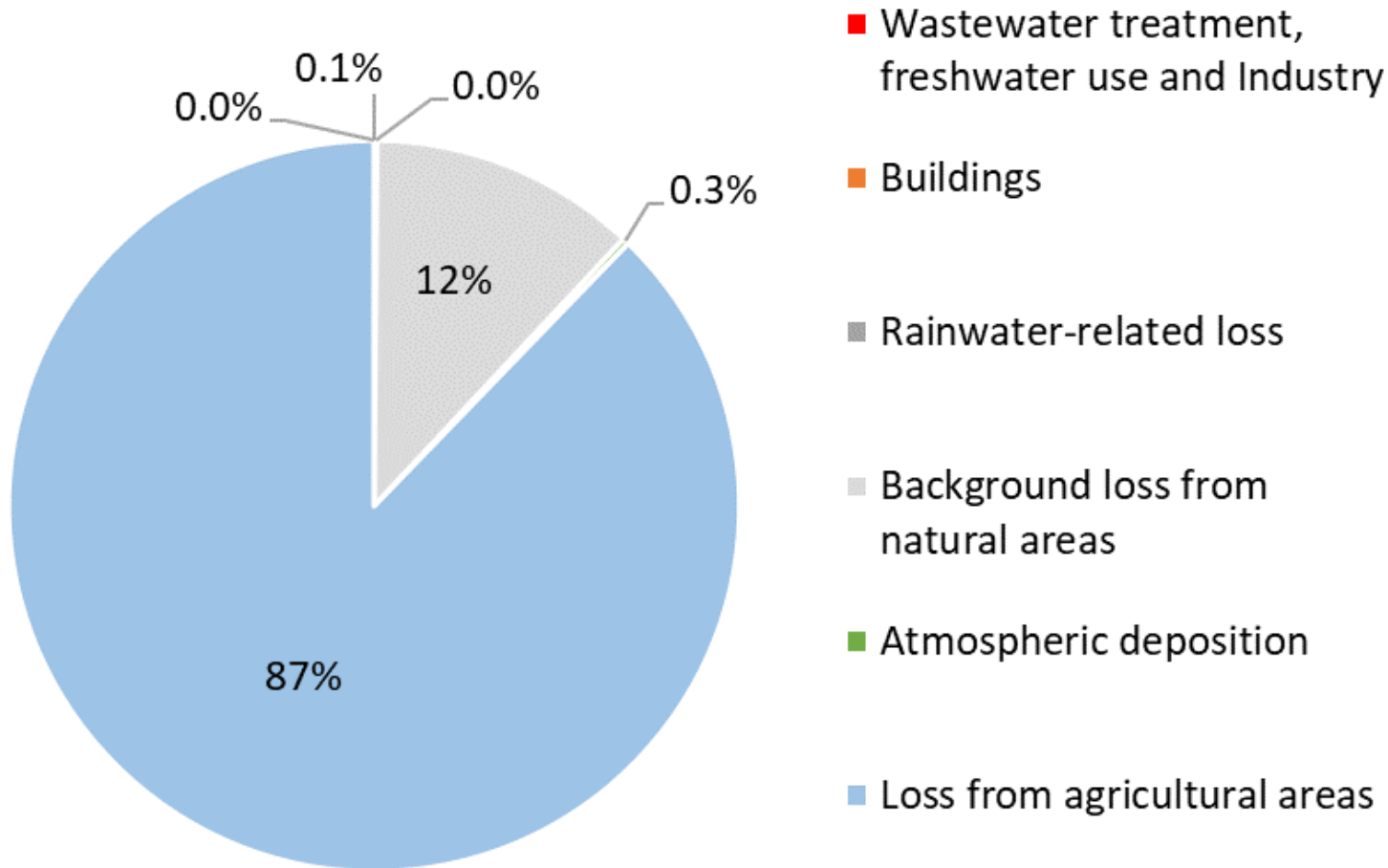


➔ ANNUAL NITROGEN TRANSPORT

Flow weighted concentration= $C_Q = T_{TN} / R_Q$

SOURCE APPORTIONMENT

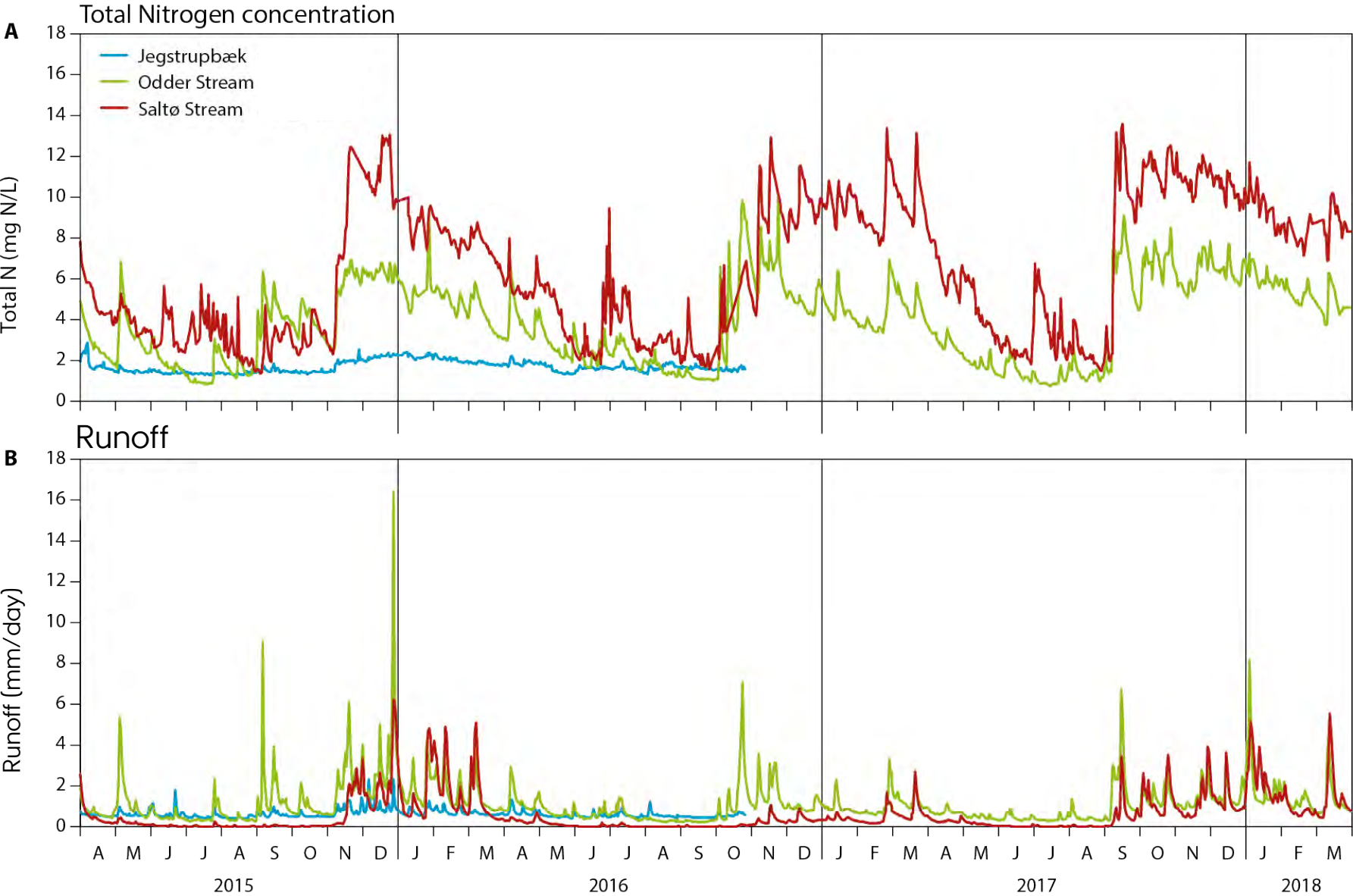
Saltø Stream



percentage (R_0),
estimated:

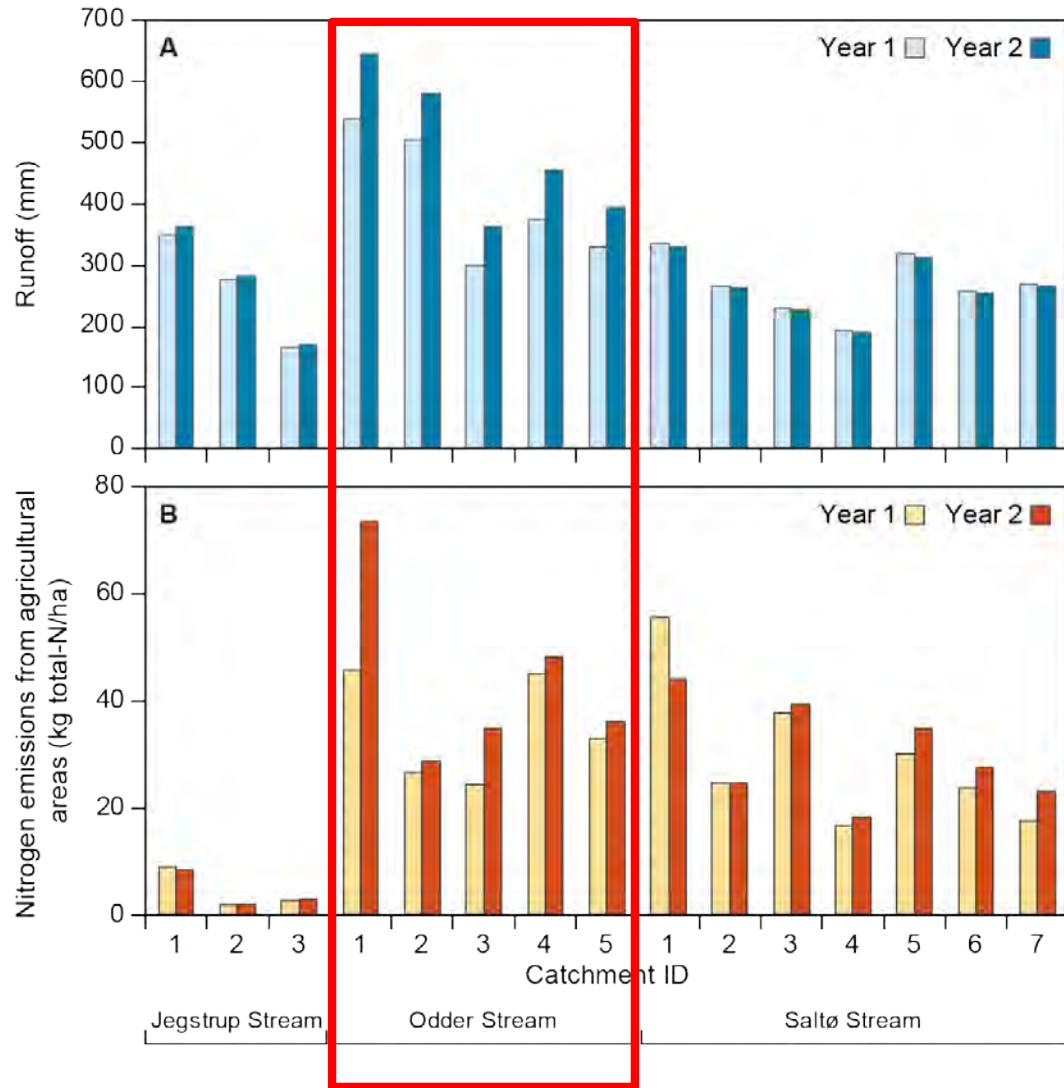
...culated utilizing a
source apportionment taking into account nitrogen retention in surface water

THE THREE CATCHMENTS



	Baseflow index
Jegstrup Stream	0.81
Odder Stream	0.56
Saltø Stream	0.40

DIFFERENCES BETWEEN THE TWO MONITORING YEARS



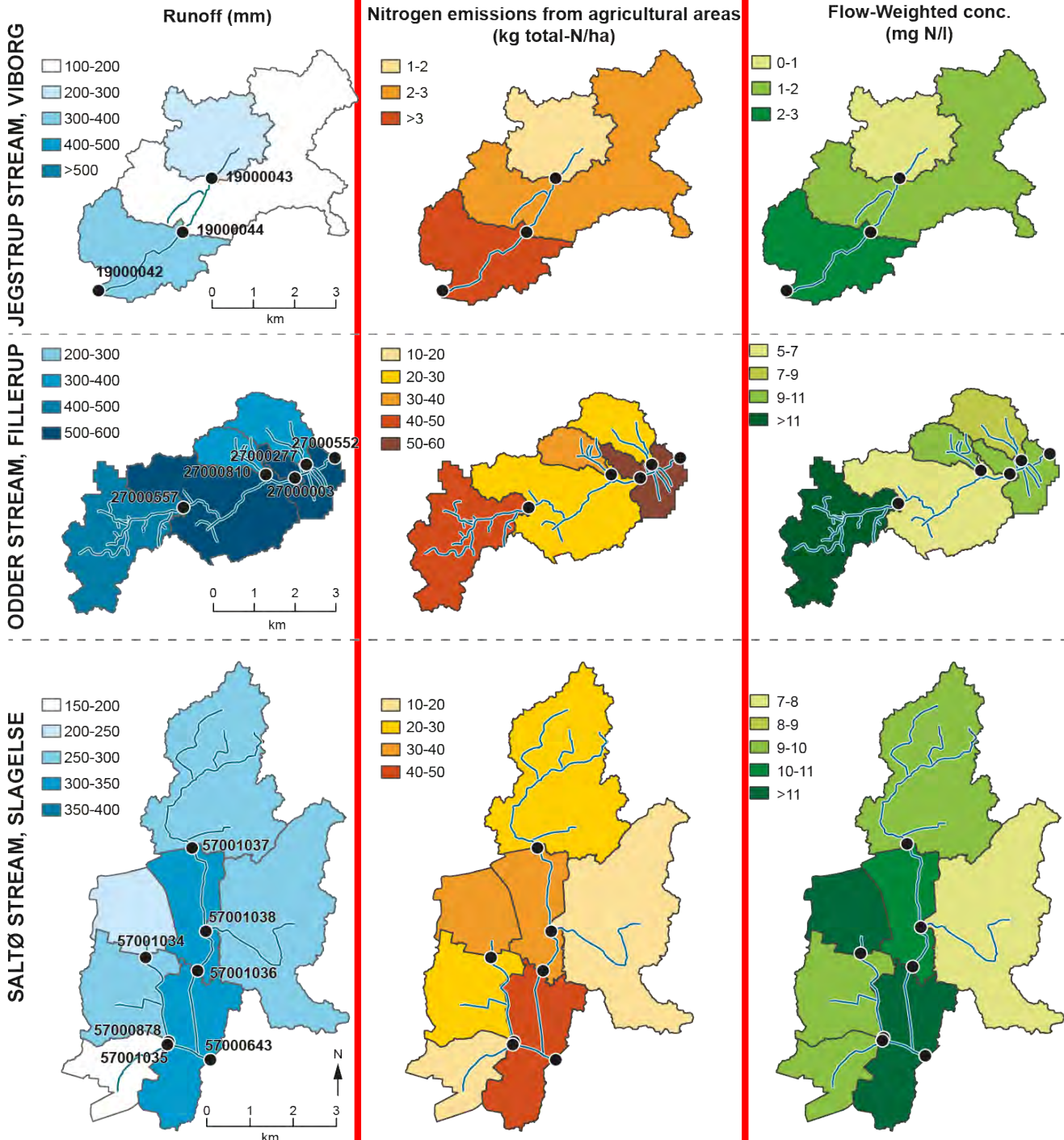
Year 1: October 2014- October 2015
Year 2: October 2015- October 2016



A NITROGEN EMISSION MAP

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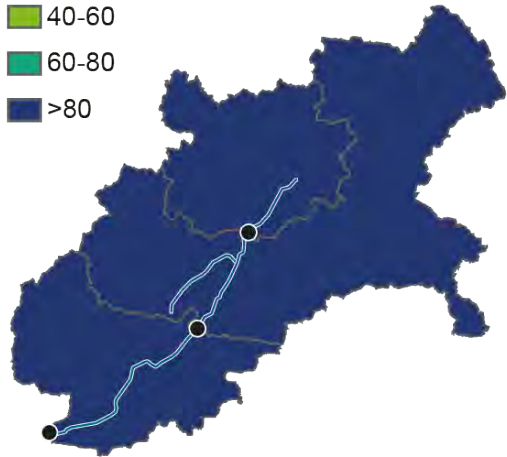
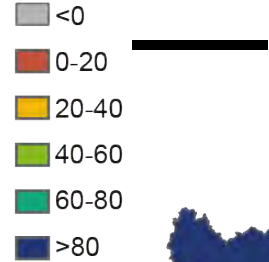
Average for the two years
Year 1: October 2014- October 2015
Year 2: October 2015- October 2016



RETENTION IN GROUNDWATER

JEGSTRUP STREAM, VIBORG

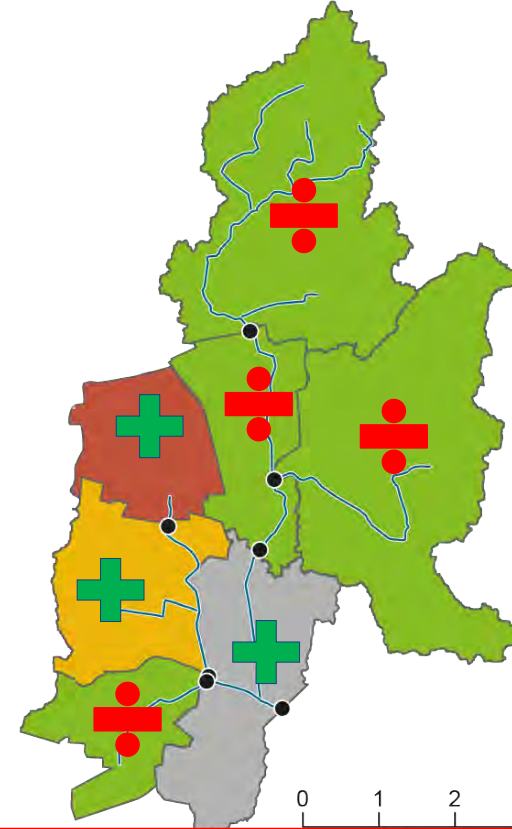
Groundwater nitrogen retention (%)



ODDER STREAM, FILLERUP



SALTØ STREAM, SLAGELSE



Uncertainty = 10%
Because of only 2
monitorings year
(Christensen & Højberg, 2018)

Location of mitigation measures



The retention varies between 0 – 60%
Based on The Danish National Nitrogen Model: 38-42%
(Saltø Stream = 3 ID15 catchments)

CONCLUSION

- Measurements of nitrogen emissions in streams provide a good opportunity for developing a local nitrogen emission map from agricultural areas on a scale down to 200-1200 ha (close to the farm) It should be noted that it requires that the catchments areas is defined with reasonable accuracy
- Large variation in nitrogen emission from agricultural areas and nitrogen retention in groundwater between sub-basins in Saltø Stream and Odder Stream.
- Knowledge can be used to optimize agricultural practice - and / or where mitigation measures must be located
- Measurements of nitrogen in streams can be used to calibrate nitrogen retention on a local scale and thereby optimize the dosage of targeted mitigation measures such as catch crops and mini-wetlands in the collective regulation.

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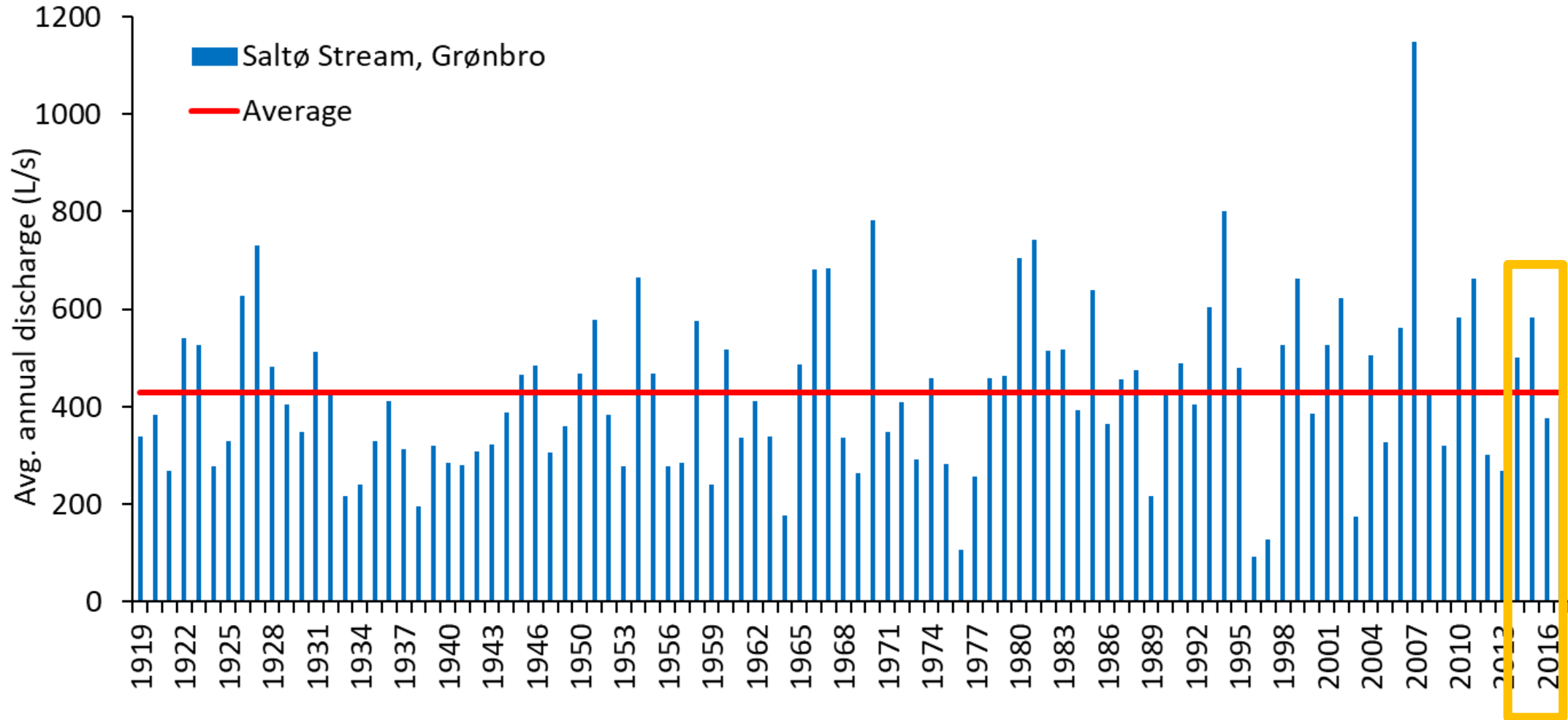


Thank you for your attention ☺



Catchmen ID	Station nr.	Name	Catchment area (ha)	Agricultural area (%)
1	19000042	Hovedstation, Tingvad bro	541	77
2	19000043	Jegstrup bæk, Viborg	448	68
3	19000044	Jegstrup bæk, Jegstrupvej	1183	54
	Total catchment Jegstrup stream		2173	63
1	27000552	Hovedstationen, OS Odder by	202	59
2	27000003	Odder Å, Naturstyrelsen	692	72
3	27000277	Dyrehave bæk, Bjørnegrotten	217	71
4	27000557	Odder Å Lundsgaard	543	55
5	27000810	Ulvskov bæk, Vandværket	132	54
	Total catchment Odder Stream		1786	57
1	57000643	Hovedstation, Ting Jellinge bro	485	79
2	57000878	Pibergrøft	403	87
3	57001034	Ellebæk	298	88
4	57001035	Maglemose rende	266	94
5	57001036	Piber å	347	83
6	57001037	Snogebæk	945	55
7	57001038	Snogebæk Tilløb	992	80
	Total catchment Saltø Stream		3737	77

LONGER TERM DISCHARGE IN SALTØ STREAM, FURTHER DOWNSTREAM FROM OUR SAMPLING STATION



Year 1: October 2014- October 2015

CAT Year 2: October 2015- October 2016